

09/74/195

ABSTRACT OF THE DISCLOSURE

A semiconductor device manufacturing process for forming a semiconductor device having a high density region and a low density region of transistor elements, includes forming a gate oxide film and gate electrodes on a semiconductor substrate surface. Then, a first nitride film is uniformly formed on the gate electrodes, and only the low-density region of the semiconductor device is etched. Then, a second nitride film is uniformly formed, and then an interlayer insulating film is formed. The high-density region is self-aligned using the first nitride film as an etch stopper to form contact holes in the interlayer insulating film, and contact electrodes are formed in the contact holes. The assembly is then annealed by a forming gas to recover an interfacial layer.

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To manufacture a semiconductor device having high- and low-density regions of transistor elements on a single semiconductor substrate, a gate oxide film and gate electrodes are formed on a surface of the semiconductor substrate, and oxide films are formed on the gate electrodes. Then, a first nitride film is uniformly formed, and only the low-density region is etched. Then, a second nitride film is uniformly formed, and an interlayer insulating film is formed. Voids are eliminated by annealing the assembly in water vapor. The high-density region is self-aligned using the first nitride film as an etching stopper to form contact holes in the interlayer insulating film, and contact electrodes are formed in the contact holes. Finally, the assembly is annealed by a forming gas to recover an interfacial level. Since the second nitride film is positioned on the surface of the semiconductor substrate in the low-density region, an impurity is prevented from being diffused from the interlayer insulating film into the semiconductor substrate and the semiconductor substrate is prevented from being oxidized when the assembly is annealed in water vapor.

- 25 The second nitride film does not prevent the forming gas from being diffused.

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